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PHARMACOLOGICAL AND CHEMICAL INVESTIGATIONS OF
CERTAIN VENOMOUS MARINE ANIMALS

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Los Angeles, California

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UNIVERSITY OF SOUTHERN CALIFORNIA
DEPARTMENT OF BIOLOGICAL SCIENCES

Final Report

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PHARMACOLOGICAL AND CHEMICAL INVESTIGATIONS
OF
CERTAIN VENOMOUS MARINE ANIMALS

Period: 1 December 1956 - 31 August 1967

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Summary of Results

The research carried out under the present contract has involved the pharmacological and chemical investigation of the venoms of a number of marine animals. The animals from which the venoms were obtained have been responsible for a substantial number of serious and in some cases fatal injuries in man, and constitute a hazard to individuals engaged in work or recreation in many areas of the Pacific and Indian Oceans. At the time the research was initiated, essentially no information was available as to the chemical nature or pharmacological actions of the venoms, and treatment of casualties was of a purely symptomatic nature.

The work was initiated with a study of three fishes of the scorpionfish family: Synanceja horrida and Synanceja verrucosa ("stonefish"), Pterois volitans ("lionfish," "zebrafish," "turkeyfish"), and Scorpaena guttata ("California scorpionfish"). Synanceja and Pterois were collected by the principal investigator in the field in Singapore and Eniwetok respectively, and preliminary studies carried out in these locations for the purpose of determining the activity and stability of venoms obtained from fresh fish. Samples were then shipped to the United States for more detailed studies; additional material has been shipped to Los Angeles from field collectors during the course of the studies. The work was carried out from 1 December 1956 through 31 August 1958 at the Scripps Institution of Oceanography in La Jolla, California, while the principal investigator was on leave from the University of Southern California, and subsequently at the University of Southern California.

Studies were initiated on the venoms of several species of mollusks of the genus Conus, which have been responsible for envenomations in humans. Work has been carried out with Conus striatus, Conus textile, and Conus geographus collected in Guam, and with Conus californicus, which is available in large numbers in California.

Preliminary investigations have been made on the venoms of some other marine animals, including several coelenterates found in California, and it is hoped that these and other studies can be pursued further at a later date.

The results of the studies have appeared in the publications listed below, all of which report work which was supported entirely under the present contract.

A color motion picture film (narrated) entitled "Venomous Animals

of the Sea" was prepared under the present contract. Prints were supplied to the Office of Naval Research under terms of the contract. Additional prints have been purchased by a number of educational and scientific institutions. The film has been screened for a large number of persons in the United States and abroad, and it is anticipated that there will be a continuing interest in the film in future years. The original copy is stored at Stanton Films, 7934 Santa Monica Boulevard, Los Angeles, California, and prints of the 34-minute film are available following authorization by Dr. Paul R. Saunders.

Publications Resulting from Research (Exclusive of Abstracts)

1. Saunders, P. R., "Venom of the stonefish Synanceja verrucosa, Science 129, 272 (1959).
2. Saunders, P. R. and Taylor, P. B., "Venom of the lionfish Pterois volitans," Am. J. Physiol. 197, 437 (1959).
3. Saunders, P. R., "Venoms of scorpionfishes," Proc. West. Pharm. Soc. 2, 47 (1959).
4. Saunders, P. R., "Venom of the stonefish Synanceja horrida (Linnaeus)" Arch. intern. Pharmacodyn. 123, 195 (1959).
5. Saunders, P. R. and Lifton, S. E., "Sting by a venomous lionfish," U. S. Armed Forces Med. J. 11, 224 (1960).
6. Kohn, A. J., Saunders, P. R., and Wiener, S., "Preliminary studies on the venom of the marine snail Conus," Ann. N. Y. Acad. Sci. 90, 706 (1960).
7. Saunders, P. R., "Pharmacological and chemical studies of the venom of the stonefish (Genus Synanceja) and other scorpionfishes," Ann. N. Y. Acad. Sci. 90, 798 (1960).
8. Saunders, P. R. and Wolfson, F., "Food and feeding behavior in Conus californicus Hinds, 1844," Veliger 3, 73 (1961).
9. Saunders, P. R. and Tokes, L., "Purification and properties of the lethal fraction from the venom of the stonefish Synanceja horrida (Linnaeus)," Biochim. Biophys. Acta 52, 527 (1961).
10. Saunders, P. R., Rothman, S., Medrano, V. A. and Chin, H. P., "Cardiovascular actions of venom of the stonefish Synanceja horrida," Am. J. Physiol. 203, 429 (1962).

11. Whysner, J. A. and Saunders, P. R., "Studies on the venom of the marine snail Conus californicus," Toxicon 1, 113 (1963).
12. Whysner, J. A. and Saunders, P. R., "Purification of the lethal fraction of the venom of the marine snail Conus californicus," Toxicon 4, 177 (1966).
13. Deakins, D. E. and Saunders, P. R., "Purification of the lethal fraction of the venom of the stonefish Synanceja horrida (Linnaeus)," Toxicon 4, 257 (1967).

Students Trained with Support from Contract

Students whose professional training was supported entirely or in part with funds from this contract are listed below:

1. Donald E. Deakins (received M.S. in Pharmacology, University of Southern California, 1964).
2. John A. Whysner (M.D. -Ph.D. work now in progress, University of Southern California).
3. Peter B. Taylor (received Ph.D. in Oceanography, Scripps Institution of Oceanography, University of California, 1963).
4. Sol Rothman (received M.D., University of Southern California).
5. Victor Medrano (received M.D., University of Southern California).
6. Laszlo Tokes (received Ph.D. in chemistry, University of Southern California).

Addendum

Research which was initiated under this contract on the venom of the California scorpionfish is now being extended under ONR Contract No. N00014-67-C-0390 awarded to the Attending Staff Association, Los Angeles County General Hospital (Principal Investigator: Findlay E. Russell, M.D.). Dr. Paul R. Saunders is collaborating with Dr. Russell in this work.